









Affordable Bimmer

RECENTLY INTRODUCED TO THE UNITED STATES, the BMW 318 ti is a three-door coupe that breaks (just) the 20-G price mark, with \$19,900 base. The ti shares the same wheelbase and 1.8-liter dual-overhead-cam 16-valve four-cylinder engine as others in the German maker's 3-series. Peppier pickup comes from its lighter body; the end is 8.8 inches shorter than other 318s.

Heads Up

THE RUGGED pocket-size Hummingbird is a full-function computer system with a head-up display controlled by optional voice-recognition software, leaving your hands free. Mobile and wireless, the unit puts tech manuals, records, or documents right before your eyes. Price: \$3,700. Phoenix Group, 204 Terminal Dr., Plainview NY 11803.



Maxi Zoom

TAMRON'S F/5.6 200-400MM ZOOMER is no bigger than a fixed-focus 400mm lens of the same aperture. Two of its 13 elements are LD (low-dispersion) glass, which help reduce chromatic aberration for sharp image quality. An internal focusing system means that the center of balance never changes, an important consideration in hand-held shooting. List: \$962.























INFORMATION



ROGAINE?...
...I'VE ALWAYS
WONDERED ABOUT
THAT MYSELF !!



STOP WONDERING.

Do what millions have already done. Find out now about *Rogaine* — the only proven way to regrow your own natural hair.

If you're tired of living with hair loss but weaves, transplants and toupees just aren't for you, then you owe it to yourself to find out about *Rogaine*® Topical Solution (minoxidil topical solution 2%). For male pattern baldness, only *Rogaine* has been medically proven to regrow hair.

And today, *Rogaine* is as much a part of our culture as your favorite Ziggy cartoon. So what are you waiting for? Call us. We'll have a free Information Kit in the mail to you within 24 hours.

How *Rogaine* works.

The exact mechanism by which minoxidil stimulates hair growth is unknown. But many scientists believe that *Rogaine* works, in part, by taking advantage of the existing hair's growth cycle. Prolong the growth cycle so that more hairs grow longer and thicker at the same time, and you may see improved scalp coverage. Having even a little more hair might make a difference in how you wear and style your hair.

Best of all, if you respond to treatment with *Rogaine*, the change is gradual. Since natural hair grows slowly, over time, you won't get the immediate change in your appearance — or unwanted attention — of a toupee or a hair weave.

Will *Rogaine* work for you?

Dermatologists conducted 12-month clinical tests. After 4 months, 26% of patients using *Rogaine* reported moderate to dense hair regrowth, compared with 11% of those using a placebo (a similar solution without the active ingredient in *Rogaine*).

After 1 year of use, almost half of the men who continued using *Rogaine* rated their regrowth as moderate (40%) to dense (8%). Thirty-six percent reported minimal regrowth. The rest (16%) had no regrowth.

Side effects? About 7% of those who used *Rogaine* had some itching of the scalp. (Roughly 5% of those on the placebo reported the same minor irritations.) *Rogaine* should only be applied to a normal, healthy scalp (not sunburned or irritated).

Make a commitment to see results.

Studies indicate it usually takes *at least 4 months of twice-daily treatment before there is evidence of regrowth*. If you're younger, have been losing your hair for a shorter period of time, and have less initial hair loss, you're more likely to have a better response.

Keep in mind that *Rogaine* is a treatment, not a cure. So further progress is only possible by using it continuously. If you stop using it, you will probably shed your newly regrown hair within a few months. If you respond to *Rogaine*, you'll find it's easy to make it a part of your daily routine.

The facts are free. Plus we'll send you a \$10 incentive to see a doctor.

So stop wondering if *Rogaine* is right for you. Call now **1-800-457-1070** for a confidential free Information Kit and find out. Millions of other guys already have. **And since you need a prescription to get *Rogaine***, we'll also include a list of nearby dermatologists and other doctors experienced in treating hair loss, plus a \$10 incentive to visit a doctor soon.

Rogaine®
TOPICAL SOLUTION minoxidil 2%

See next page for important additional information.

Call now for your
Free Information Kit on
Rogaine and a \$10
incentive to see a doctor

1-800-457-1070



Rogaine[®]

minoxidil 2%

The only product ever
proven to regrow hair.

What is ROGAINE?

ROGAINE Topical Solution is a prescription medicine for use on the scalp that is used to treat a type of hair loss in men and women known as androgenetic alopecia: hair loss of the scalp vertex (top or crown of the head) in men and diffuse hair loss or thinning of the front and top of the scalp in women. ROGAINE is a topical form of minoxidil, for use on the scalp.

How effective is ROGAINE?

In men: Clinical studies with ROGAINE of over 2,300 men with male pattern baldness involving the top (vertex) of the head were conducted by physicians in 27 US medical centers. Based on patient evaluations of regrowth at the end of 4 months, 26% of the patients using ROGAINE had moderate to dense hair regrowth compared with 11% who used a placebo treatment (no active ingredient). No regrowth was reported by 41% of those using ROGAINE and 58% of those using a placebo. By the end of 1 year, 48% of those who continued to use ROGAINE rated their hair growth as moderate or better.

In women: A clinical study of women with hair loss was conducted by doctors in 11 US medical centers. Based on patients' self-ratings of regrowth after 32 weeks, 59% of the women using ROGAINE rated their hair regrowth as moderate (19%) or minimal (40%). For comparison, 40% of the women using placebo (no active ingredient) rated their hair regrowth as moderate (7%) or minimal (33%). No regrowth was reported by 41% of the group using ROGAINE and 60% of the group using placebo.

How soon can I expect results from using ROGAINE?

Studies show that the response time to ROGAINE may differ greatly from one person to another. A temporary increase in hair shedding may occur 2 to 6 weeks after starting treatment with ROGAINE as some hair follicles shift from the resting phase to the growth phase (as new hair growth begins, old hairs are released). An increase in shedding should not last more than a few weeks. If it does, your physician will need to rule out other causes. Successful hair regrowth can only be evaluated after continuous, twice-daily treatment for 4 months or longer.

How long do I need to use ROGAINE?

ROGAINE is a hair-loss treatment, not a cure. If you have new hair growth, you will need to continue using ROGAINE to keep or increase hair regrowth. If you do not begin to show new hair growth with ROGAINE after a reasonable period (at least 4 months), your doctor may advise you to discontinue using ROGAINE.

What happens if I stop using ROGAINE? Will I keep the new hair?

Probably not. People have reported that new hair growth was shed after they stopped using ROGAINE.

How much ROGAINE should I use?

You should apply a 1-ml dose of ROGAINE twice a day to your clean dry scalp, once in the morning and once at night before bedtime. Wash your hands after use if your fingers are used to apply ROGAINE. ROGAINE must remain on the scalp for at least 4 hours to ensure penetration into the scalp. Do not wash your hair for at least 4 hours after applying it. If you wash your hair before applying ROGAINE, be sure your scalp and hair are dry when you apply it. Please refer to the instructions for Use in the package.

What if I miss a dose or forget to use ROGAINE?

Do not try to make up for missed applications of ROGAINE. You should restart your twice-daily doses and return to your usual schedule.

What are the most common side effects reported in clinical studies with ROGAINE?

Itching and other skin irritations of the treated scalp area were the most common side effects directly linked to ROGAINE in clinical studies. About 7 of every 100 people who used ROGAINE (7%) had these complaints.

Other side effects, including light-headedness, dizziness, and headaches, were reported both by people using ROGAINE and by those using the placebo solution with no minoxidil. You should ask your doctor to discuss side effects of ROGAINE with you.

People who are extra sensitive or allergic to minoxidil, propylene glycol, or ethanol should not use ROGAINE.

ROGAINE Topical Solution contains alcohol, which could cause burning or irritation of the eyes or sensitive skin areas. If ROGAINE accidentally gets into these areas, rinse the area with large amounts of cool tap water. Contact your doctor if the irritation does not go away.

What are some of the side effects people have reported?

ROGAINE was used by 3,857 patients (347 females) in placebo-controlled clinical trials. Except for dermatologic events (involving the skin), no individual reaction or reactions grouped by body systems appeared to be more common in the minoxidil-treated patients than in placebo-treated patients.

Dermatologic: irritant or allergic contact dermatitis - 7.36%; **Respiratory:** bronchitis, upper respiratory infection, sinusitis - 7.16%; **Gastrointestinal:** diarrhea, nausea, vomiting - 4.33%; **Neurologic:** headache, dizziness, faintness, light-headedness - 3.42%; **Musculoskeletal:** fractures, back pain, tendonitis, aches and pains - 2.55%; **Cardiovascular:** edema, chest pain, blood pressure increases/decreases, palpitations, pulse rate increases/decreases - 1.53%; **Allergic:** nonspecific allergic reactions, hives, allergic rhinitis, facial swelling, and sensitivity - 1.27%; **Metabolic-Nutritional:** edema, weight gain - 1.24%; **Special Senses:** conjunctivitis, ear infections, vertigo - 1.17%; **Genital Tract:** prostaticitis, epididymitis, vaginitis, vulvitis, vaginal discharge/itching - 0.91%; **Urinary Tract:** urinary tract infections, renal calculi, urethritis - 0.93%; **Endocrine:** menstrual changes, breast symptoms - 0.47%; **Psychiatric:** anxiety, depression, fatigue - 0.36%; **Hematologic:** lymphadenopathy, thrombocytopenia, anemia - 0.31%.

ROGAINE use has been monitored for up to 5 years, and there has been no change in incidence or severity of reported adverse reactions. Additional adverse events have been reported since marketing ROGAINE and include eczema, hypertrichosis (excessive hair growth), local erythema (redness), pruritus (itching); dry skin/scalp flaking, sexual dysfunction, visual disturbances, including decreased visual acuity (clarity); increase in hair loss; and alopecia (hair loss).

Can ROGAINE Topical Solution cause unwanted hair growth?

Facial hair growth has been reported with the use of ROGAINE, particularly by women. The cause is unknown but may be related to continuous, unintentional exposure of the face to the medicine or to hair follicles on the face that are extremely sensitive to very low levels of medicine absorbed from the scalp. To minimize the chances of hair growth on the forehead or temples, wash your hands after applying ROGAINE and be careful not to transfer the medicine from your scalp to other parts of your body.

What are the possible side effects that could affect the heart and circulation when using ROGAINE?

Serious side effects have not been linked to ROGAINE in clinical studies. However, it is possible that they could occur if more than the recommended dose of ROGAINE were applied, because the active ingredient in ROGAINE is the same as that in minoxidil tablets. These effects appear to be dose related; that is, more effects are seen with higher doses.

Because very small amounts of minoxidil reach the blood when the recommended dose of ROGAINE is applied to the scalp, you should know about certain effects that may occur when the tablet form of minoxidil is used to treat high blood pressure. Minoxidil tablets lower blood pressure by relaxing the arteries, an effect called vasodilation. Vasodilation leads to fluid retention and faster heart rate. The following effects have occurred in some patients taking minoxidil tablets for high blood pressure:

Increased heart rate: some patients have reported that their resting heart rate increased by more than 20 beats per minute.

Salt and water retention: weight gain of more than 5 pounds in a short time or swelling of the face, hands, ankles, or stomach area.

Problems breathing: especially when lying down; a result of a buildup of body fluids or fluid around the heart.

Worsening or new attack of angina pectoris: brief, sudden chest pain.

When you apply ROGAINE to normal skin, very little minoxidil is absorbed. You probably will not have the possible effects caused by minoxidil tablets when you use ROGAINE. If, however, you experience any of the possible side effects listed above, stop using ROGAINE and consult your doctor. Any such effects would be most likely if ROGAINE was used on damaged or inflamed skin or in greater than recommended amounts.

In animal studies, minoxidil, in much larger amounts than would be absorbed from topical use (on skin) in people, has caused important heart-structure damage. This kind of damage has not been seen in humans given minoxidil tablets for high blood pressure at effective doses.

What factors may increase the risk of serious side effects with ROGAINE?

People with a known or suspected heart condition or a tendency for heart failure would be at particular risk if increased heart rate or fluid retention were to occur. People with these kinds of heart problems should discuss the possible risks of treatment with their doctor if they choose to use ROGAINE.

ROGAINE should be used only on the balding scalp. Using ROGAINE on other parts of the body may increase minoxidil absorption, which may increase the chances of having side effects. You should not use ROGAINE if your scalp is irritated or sunburned, and you should not use it if you are using other skin treatments on your scalp.

Can people with high blood pressure use ROGAINE?

Most people with high blood pressure, including those taking high blood pressure medicine, can use ROGAINE but should be monitored closely by their doctor. Patients taking a blood pressure medicine called guanethidine should not use ROGAINE.

Should any precautions be followed?

People who use ROGAINE should see their doctor 1 month after starting ROGAINE and at least every 6 months thereafter. Stop using ROGAINE if any of the following occur: salt and water retention, problems breathing, faster heart rate, or chest pains.

Do not use ROGAINE if you are using other drugs applied to the scalp such as corticosteroids, retinoids, petrolatum, or agents that might increase absorption through the skin. ROGAINE is for use on the scalp only. Each 1 mL of solution contains 20 mg minoxidil, and accidental ingestion could cause unwanted effects.

Are there special precautions for women?

Pregnant women and nursing mothers should not use ROGAINE. Also, its effects on women during labor and delivery are not known. Efficacy in postmenopausal women has not been studied. Studies show the use of ROGAINE will not affect menstrual cycle length, amount of flow, or duration of the menstrual period. Discontinue using ROGAINE and consult your doctor as soon as possible if your menstrual period does not occur at the expected time.

Can ROGAINE be used by children?

No, the safety and effectiveness of ROGAINE has not been tested in people under age 18.

Caution: Federal law prohibits dispensing without a prescription. You must see a doctor to receive a prescription.

Upjohn
DERMATOLOGY
DIVISION

The Upjohn Company, Kalamazoo, MI 49001, USA

CB-6-S

MILITARY TECH

Rocket Torpedo

ONE OF MANY futuristic weapons that Russian engineers were developing in the last days of the Cold War, and have now revealed to the world, is an underwater missile designed to hurtle through the ocean at tremendous speeds.

Conventional torpedoes, which are driven by propellers, go no faster than 70 mph. But a solid rocket motor, like the ones used in missiles, enables the Russian weapon to travel through the water at speeds up to 335 mph, giving the target no chance to take evasive action or use decoys.

Designed by engineers at Region, a Moscow company that was formerly a design bureau under the Soviet Ministry of Defense, the cone-shaped underwater missiles could be made in a variety of sizes. Missiles as small as an inch in diameter could be used to defend ships by intercepting incoming torpedoes. Missiles the size of the biggest torpedoes, weighing up to 3,000 pounds, could destroy a ship or submarine with one hit. The largest missiles would have a range of about six miles and would be guided by sonar signals.

The guided versions face some technical challenges. The missile is so noisy at high speeds that it is deaf to any sonar echoes. So it is designed to slow down about a mile from its target, listen for sonar signals, and then adjust its aim before re-accelerating for its final attack.

The weapon travels so fast that it creates an air bubble behind it, which makes control fins useless. Instead, the weapon is steered by small thruster rockets.

Region has already tested prototypes of the new weapon. The company is looking for a foreign partner to complete development of its underwater missile.—Bill Sweetman



















Camcorder Links to TV or VCR by Infrared

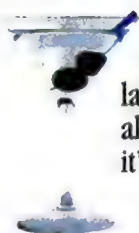
THE JOY OF camcorder use is instant gratification. You shoot some footage at a party and you can play it back as quickly as you can connect the camcorder to a TV. But Hitachi's new VM-H81A Hi8 camcorder (\$2,099) lets you skip the connection step and transmit video and stereo audio directly to a TV or VCR without wires.

The signals are emitted by a pair of LEDs controlled by a tiny infrared transmitter inside the camcorder. A small receiver converts the signals back into standard video and audio before passing them to the TV through conventional A/V cables. The receiver stays plugged into the TV.

I tried the system, called Optical Link, and found it delivers as promised. To use it effectively, you'll need to put your camcorder on a table or other surface about 2 to 10 feet in front of the receiver. Image quality is very good within this range, and up to about 30 degrees on either side of center as well as above and below. You'll also need a line of sight. People, pets, or other moving objects that get between the camcorder and the receiver will glitch the picture. So will lamplight shining directly on the receiver; cordless phones and small appliances seem to offer no interference.

Optical Link will not pass along a live picture, however. For that you'll need the cable. A longer infrared range would also be helpful. One advantage is that you can run the camera from almost anywhere in a room using its credit card-sized remote control.

For playback convenience, this is a camera that literally stands alone.—*Stan Pinkwas*



When it comes to vodka, the choice is clear. **SKYY VODKA** has a unique four-column distillation and three-step filtration process which always ensures exceptional quality. **SKYY VODKA**; it's the Ultra Premium choice.

Try a **SKYY** Martini with Vermouth, shaken not stirred.

SKYY VODKA
The Intelligent Drink.

DISTILLED IN AMERICA FROM AMERICAN GRAIN

40% ALC/VOL (80 PROOF). 100% GRAIN NEUTRAL SPIRITS. ©1995 SKYY SPIRITS, INC. SAN FRANCISCO, CA. BE RESPONSIBLE. DON'T DRINK AND DRIVE.





New Technology Improves Sleep Quality

Chances are, you need better sleep. Thanks to advances in sleep surface technology, now you can get it!

America has become a nation of the chronically sleep-deprived. The Better Sleep Council reports that over the past 20 years, we Americans have added around 158 hours, or nearly an entire month each year, to our job schedules. That's not to mention the time we spend working hard to care for our families and homes. Sleep deprivation is caused by both lack of time spent sleeping and poor quality sleep. Sound familiar? Then you owe it to yourself to read on!

SLEEP DEPRIVATION CAN BE DANGEROUS

According to the AAA Foundation for Traffic Safety, sleep-deprived drivers are vulnerable to "micro-naps" lasting four or five seconds—plenty of time at highway speeds for a fatal crash to occur. Disrupted sleep and sleep disorders cost American businesses billions of dollars annually in lost productivity, industrial accidents and higher medical bills. Lack of sleep also was implicated in the Exxon Valdez oil spill, the space shuttle Challenger disaster and the nuclear accident at Three Mile Island.

Loss of sleep during the night is responsible for increased vulnerability to illness, a tendency to nod off at work the next day, and even loss of creativity and clarity of thinking, say British researchers. Power tools can become dangerous weapons in the hands of someone who is not well rested. And almost everyone is familiar with the physical aches and pains that occur because of poor quality sleep.

DO YOU NEED MORE SLEEP, OR JUST BETTER SLEEP?

On the average, most adults require seven and a half to eight hours of sleep per night, and a full cycle including deep sleep is required for us to feel adequately rested in the morning. Any number of factors can interfere with

deep, nourishing sleep—including cigarette smoking, worry, a noisy environment and physical discomfort.

Air-cushioned support has been proven to positively affect all three factors that determine the quality of sleep: spinal alignment, pressure points and physiology.

We try remedies from pain medication and sleeping pills, to chiropractic care and self-relaxation techniques in order to get better sleep and rid ourselves of morning aches and pains. But new sleep surface technology offers a simpler solution for many people who toss and turn.

THE FIRST REAL BREAKTHROUGH IN SLEEP SURFACE TECHNOLOGY IN OVER 100 YEARS

Even if you just bought a new bed, you may be sleeping on an antiquated surface! Developed a century ago, innerspring mattresses can create pressure points that interfere with total relaxation. Waterbeds made a big splash in the '60s, but even those labeled "firm" can produce a hammock effect, which can cause the spine to curve unnaturally. Fortunately, a new technology has come through test after test with flying colors: Select Comfort Air Sleep Systems™.

The Select Comfort adjustable firmness mattress uses air which distributes body weight more evenly and provides better support.

While it looks like a traditional mattress on the outside and even fits standard sheet sizes, the Select Comfort mattress is completely unique on the inside. Air is captured inside innovative "I-beam" chambers that contour to the body, provide proper spinal support, reduce pressure points and evenly distribute weight for better sleep.

What's more, each side of the Select Comfort adjustable firmness mattress is independently adjustable—with a remote hand control that digitally tells you the

firmness level that's perfect for you. And, you can let air in or out to change the mattress firmness, depending upon how your body feels each night. This is essential for couples, because two people of different shapes and sizes cannot sleep on the same surface and both be as comfortable as they should be to achieve the best possible sleep.

MADE-IN-MINNESOTA QUALITY

Select Comfort adjustable firmness mattresses are manufactured in Minneapolis, Minnesota, and tested for comfort and durability by independent laboratories. Well on its way to becoming a worldwide leader in state-of-the-art sleep systems, Select Comfort currently is the fastest growing company in America's bedding industry, and has earned 22 U.S. patents.

LIGHTWEIGHT AND EASY TO SET UP YOURSELF

The Select Comfort adjustable firmness mattress is so lightweight, it can be delivered via UPS in one carton. Following the simple instructions, one person can set up the system at home, usually in 30 minutes or less. An attached electronic air pump fills the mattress with the right amount of air, and then hides out of sight under the bed. Dual controls allow each sleeping partner to adjust the sleep surface to their desired firmness.

TRY SELECT COMFORT AT NO RISK FOR 90 NIGHTS

Thousands of people from coast to coast already own a Select Comfort adjustable firmness mattress. You can try one, too, protected by a "No-Risk 90 Night" guarantee and up to a 20-year limited product warranty. Call our sleep consultants and ask them about your particular sleep needs. They can answer all your questions and help you better understand how you can benefit from a Select Comfort adjustable firmness mattress.

For a free brochure and introductory video, call 1-800-831-1211, Ext. 4521.













Tier II Plus carries more equipment than DarkStar, packing both a radar and an optical-and-infrared sensor. The radome above the nose covers a 48-inch steerable satellite communications dish that can securely transmit real-time, high-resolution video. Tier II Plus will also wield a complete set of electronic defenses, including jammers and towed decoys to discourage attacking fighters or missiles.

The new drones share some key technologies, in particular, **three different types of sensors that transmit data in real time.** Smart control systems also make them the first aerial military robots capable of completing missions autonomously, even in the face of equipment failures or other unexpected problems. Reliability is crucial, not just because drones cost money but because a runaway drone is an unguided missile.

On-board computer intelligence is essential to reliability. Both drones have more than one control surface for each axis of movement. If the electric actuator that moves one aileron fails, the fly-by-wire system will detect the failure and adjust the motions of the other surfaces so that the drone flies properly.

Should one of the new drones lose its satellite link to the ground, it automatically returns to its base and orbits nearby until its operators activate a back-up link and order it to land.

Advanced-drone production should begin in a few years. The Pentagon expects to buy 20 of each but is waiting to see the results of an exhaustive series of tests in 1998 and '99 before deciding on exact numbers.

DARO chief Major General Ken Israel says the new drones "will reshape the military capabilities of the 21st century." In a shooting war like Desert Storm, DarkStars would be programmed to arrive just after a strike by aircraft or cruise missiles, taking pictures before the adversary can try to conceal or fake damage. The drones would search large areas for targets that look like missile launchers, automatically snapping

Filmless Spy Pix

MILITARY COMMANDERS don't see any use for a costly drone that can't detect targets at night or in bad weather. And few things are more frustrating than having a hundred images stored on camera film stuck in a drone circling at 65,000 feet.

Today's drones solve that problem by using three types of sensors: electro-optical, infrared, and synthetic-aperture radar (SAR). They all transmit data in real time, and none of them uses film.

The latest high-resolution electro-optical sensors, superb versions of the home video camera, are used in clear-weather, daylight conditions. Infrared sensors measure heat and work day or night. SAR, which sees only its own microwave beams reflecting back from the landscape below, isn't bothered by stormy weather.

Early electro-optical sensors had lower resolution than film. Now sensors with millions of elements on a single silicon wafer are approaching film quality. Photo interpreters rate image quality according to the Image Interpretability Rating Scale (IIRS, pronounced "ears"). Built by Recon-Optical, the DarkStar sensor delivers "ears five" performance, good enough to tell a Scud missile launcher from the more modern SS-23 Spider. It can search a 90-mile square to that level of detail in an hour.

The drones' sensors cover such a wide spectrum that it will be very

hard for an adversary to remain concealed. Some types of camouflage can fool an optical sensor, but not an infrared one. People in the open are "sore-thumb" targets on infrared, unless they have been dead for a while. Infrared can also distinguish aircraft and vehicles that have moved recently from those that have not, by detecting the residual heat radiating from their engines.

Radar works day or night, but its resolution is limited by antenna size, also referred to as aperture. A SAR gets around this problem by using a side-looking antenna aboard a moving aircraft to synthesize a larger "virtual" antenna. SAR produces a detailed image by combining a series of radar snapshots. The effect is the same as having an immense antenna.

Both the Westinghouse TESAR (tactical, electronically scanned SAR) for DarkStar and the Hughes SAR for Tier II Plus provide near-photographic image quality. One Pentagon official has called TESAR imagery "exquisite." The Tier II Plus specification called for a radar with one-yard resolution in mapping mode—adequate to distinguish cars from trucks—and a resolution down to one foot in "spotlight" mode.

SAR can't see moving objects, but the SARs on the drones have an added moving target indication mode that superimposes moving vehicles on the radar image.—B.S.

high-resolution images—as many as 80 an hour—so that interpreters on the ground can identify them and transmit their precise location to strike aircraft and missiles.

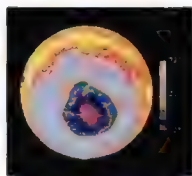
The Tier II Plus could also be used for humanitarian missions, such as searching for aircraft- or boat-wreck survivors, or tracking the progress of floods and forest fires. And if the drone builders can hold the price at \$10 million, there could be a civilian market for environmental monitor-

ing. The Federal Aviation Administration has already started to define the rules under which civilian drones would operate.

Reliable, responsive, all-weather reconnaissance is a commander's dream. Its potential is limited not so much by the performance of the robot spy birds and their all-seeing sensors, as by the ability of institutions on the ground to distribute the imagery this technology provides. Where's a bad guy to hide nowdays? ♦







1969	1969	1973	1976	1976	1970s	1981	1985	1989	1990	1994
ARPANET communications network, the predecessor of the Internet, developed	Nell Armstrong becomes the first man on the moon	Stanley Cohen & Herbert Boyer demonstrate DNA splicing in <i>E. coli</i> bacteria	Viking I and Viking II make soft landings on Mars surface	National Academy of Sciences reports that chlorofluorocarbons can deplete the ozone layer	Magnetic resonance imaging developed	First flight of the space shuttle	Buckminsterfullerene , the third elemental form of carbon is discovered	Human genome project started	Hubble Space Telescope launched	Top quark discovered at Fermi National Accelerator Laboratory

REP. BROWN: You have to admire them. They're doing exactly what they promised to do. But they are absolutely wrong in doing it, and of course the only hope of changing it is if the public will understand that instead of preserving our future generation's stake in society, we're undercutting it.

They're saying that we've got to balance the budget because otherwise it's a burden on our children and our grandchildren. Well, if you cut the budget by cutting the programs that increase productivity and competitiveness, you're going to eliminate the future of our children and grandchildren just as much as if

you continue to pile up debt. They're both bad.

PS: Mr. Walker says that basic science is protected under the Republican plan, and only pork-barrel programs are axed.

REP. BROWN: Walker is a very skilled debater. He talks fast. He doesn't really care what he says. He makes his point by impact.

What he's done is to politicize technology initiatives that the Reagan and Bush administrations worked so hard to get started. He tries to bad-mouth them, to denigrate any R&D investment he

objects to by calling it "corporate welfare" or "not real science."

Of course, that kind of terminology is aimed at winning the hearts and minds of the electorate. Whether he succeeds or not depends on how gullible the electorate is.

PS: What's wrong with what the Republicans are doing to NASA?

REP. BROWN: I think that if anybody can find a way to run NASA more efficiently, administrator Goldin will. He's proven his ability to cut costs in every way possible without sacrificing basic goals.

The Republican proposal goes much further. It requires NASA to

Prospects For Federal Science Research By Agency

All figures in 1995 dollars in millions, 3 percent inflation assumed.

Department of Agriculture

Current R&D budget: \$1,745

Proposed:

1996: \$1,388

2002: \$1,148

Impact: Agricultural Research Service cut 10 percent.

Department of Defense

Current R&D budget: \$35,448

Impact: Funds expected to remain the same or increase slightly.

Department of Energy

Current R&D budget: \$4,528

Proposed:

1996: \$3,142

2002: \$2,108

Impact: Research into energy

efficiency, fossil energy, and renewable energy severely cut.

Department of the Interior

Current R&D budget: \$864

Proposed:

1996: \$668

2002: \$474

Impact: U.S. Geological Survey loses 20 percent of funding; National Biological Service dissolved.

National Aeronautics and Space Administration

Current budget: \$12,828

Proposed:

1996: \$12,211

2002: \$8,672

Impact: Earth Observing System, an environmental satellite program, is hit hardest. Space shuttle is privatized.

National Institutes of Health

Current budget: \$11,330

Proposed:

1996: \$10,451

2002: \$8,752

Impact: Small across-the-board cut in 1996, then six-year budget freeze.

National Institute of Standards and Technology

Current budget: \$764

Proposed:

1996: \$335

2002: Not available

Impact: Advanced Technology Program, which gives grants to corporations to study cutting-edge technology, eliminated.

National Oceanic and Atmospheric Administration

Current budget: \$1,980

Proposed:

1996: \$1,655

2002: \$1,264

Impact: Many national weather service stations may be closed.

National Science Foundation

Current budget: \$2,691

Proposed:

1996: \$2,393

2002: \$2,147

Impact: Mostly escapes the budget scythe. But deep cuts in social and economic research.

Office of Technology Assessment

Current budget: \$22

Impact: Abolished. Advice to Congress on Science/Technical issues is eliminated.

—research by Alan Zibel









THE FACTS

Apollo 13: What the Moviemakers Missed

COMPILED BY CHRISTOPHER K. LAND
(an engineer at the Johnson Space Center)

THE PRODUCERS of the movie *Apollo 13* did an amazing job, accurately weaving thousands of genuine technical details into the story of NASA's finest hour. Leave it to a few NASA engineers to point out the things they didn't get right...

A TECHNICIAN at the cape is wearing a Rockwell International logo on his coveralls. The Apollo capsule was built by North American, which did not become Rockwell until after the Apollo program.

JIM LOVELL'S TEXAS license plate looks to be vintage 1994, which could mean he had access to a time machine and had been using it.

THE PAINT PATTERN for the Saturn V is incorrect. The original mockup model had a solid black ring atop vertical black and white stripes. All launched Saturn Vs were solid white in this segment (ring). But the craft in the movie have vertical stripes with no ring.

THE NASA WORM logo appears on a glass window. The logo was not developed until 1976.

THE ENGINES of the Saturn V were started at T-9

seconds, not zero as portrayed (T-0 was release of the hold-down bolts). This mistake was intentional because *everyone* (outside NASA) believes that engine start means liftoff.

THE GANTRY ARMS for the Saturn V are released in unison, not one at a time.

THE SLAM-BANG impact at the end of the first stage was completely unexpected, not routine as portrayed. Small retrorockets atop the first stage should have fired immediately after separation to slow the spent stage down—instead they fired one second before separation (whoops!). This thrust the astronauts forward as shown in the movie.

SECOND STAGE ignition was not explosive but rather gentle and smooth.

THE MOON changes phases a few times while Apollo 13 is en route (watch the moon a few nights in a row to see how likely this is). The phase was actually a waning crescent, with landing occurring on the near side at local sunrise so that long shadows could aid navigation.

IN MISSION CONTROL, flight director Eugene F. Kranz was called Mr. Kranz



Tom Hanks in *Apollo 13*.

or by his call sign "Flight." No one called him "Gene."

UPON PASSING behind the moon, the astronauts lose communication with Earth. At this point in the movie, a wave of darkness occurs as the spacecraft enters the dark side. But given the phase of the moon at that moment, they could not have entered the dark side for another quarter of an orbit.

ONE ENGINEER checks an astronaut's addition using a slide rule. Slide rules are not used for addition.

THE MISSION Control Center is labeled Building 30N. That's correct now; at the time it was just plain 30.

AS THE ASTRONAUTS near the moon, the sun is to the left, and the moon is in the foreground on the right. Apollo 13 appears to be about the size of Australia. Judging by the size of the moon, it is traveling at maybe 25 million miles per hour—about a thousand times faster than other Apollo spacecraft.

IN ONE SCENE, a number of reporters gather outside Jim and Marilyn Lovell's home. The setting is the middle of April in Houston, yet no one is drowning in perspiration or fighting off mosquitoes the size of lap dogs.

THE ASTRONAUTS point out the Sea of Tranquility as they pass over it. The image in the movie is actually Hadley's Rille (it looks like a river), which was the landing site for Apollo 15.

LOVELL AND HAISE are in the lunar module on the way back to Earth. In the window behind Haise is the full moon. Cut to Jim Lovell on the other side, and in the window behind him is Earth, which is also full. Full moon, full Earth—they were *way* off course or their spacecraft was as bright as the sun.

AT ONE POINT the ship is said to be rotating at 2.5 degrees per second. The view out the window shows that the rate is about five times that.

THE NAVY OFFICER greeting the men at the end of the movie looks like the real Jim Lovell, but the officer would have been 20-some years younger. (OK, it's not a real error—just a wonderfully nice touch in a movie filled with them.)

OUTSIDE THE CAPSULE in the vacuum of space, no noise can be heard from propulsion jets unless you are very close to them.

UNIVERSAL CITY STUDIOS, INC./RON BAUTZDORF

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